Selected Lancashire Emission Results from the National Atmospheric Emissions Inventory, 2022

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Lancashire County Council

David Jenks, Business Intelligence analyst

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For further information on the work of Business Intelligence, please contact us at:

Business Intelligence
Lancashire County Council
County Hall
Fishergate Hill
Preston
PR1 0LD
E: BusinessIntelligence.insight@lancashire.gov.uk
www.lancashire.gov.uk/lancashire-insight
Follow us on X (formerly Twitter) @lancsinsight

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1 Overview

This article considers a selection of the available emission results for the Lancashire-14 area. This encompasses the 12-districts that are within the Lancashire County Council area, and the two unitary authorities of Blackburn with Darwen and Blackpool.

1.1 Key findings for Lancashire-12 in 2022

- Heidelberg Materials near Clitheroe in Ribble Valley was identified as the source of 646 tonnes of NO_x, 112 tonnes of sulphur dioxide and 24.1 tonnes of particulate matter
- In Hyndburn 205 tonnes of NO_x, 63.8 tonnes of SO_2 and 23 tonnes of particulate matter were generated from industrial sources
- In West Lancashire 205 tonnes of NO_x and 55.8 tonnes of SO_2 were generated from industrial sources
- The motorways in Chorley district were sources for 403 tonnes of NO_x and 21.3 tonnes of particulate matter
- The motorways in Lancaster district were sources for 241 tonnes of NOx and 14 tonnes of particulate matter
- The motorways in South Ribble were sources for 147 tonnes of NO_x and high levels of particulate emissions (7.8 tonnes)
- The motorways in Preston were sources for 255 tonnes of NO_x and high levels of particulate emissions
- Heysham Port was the source of over 160 tonnes of NO_x
- Warton Aerodrome is identified as a source for over 70 tonnes of NO_x
- Chemical and waste processing works on the Wyre estuary produced 47 tonnes of NO_x

2 Background information

The national atmospheric emissions inventory (NAEI) has been estimating annual emissions since 1970. The organisation collects and analyses information from a wide range of data sources that include national energy statistics and results for individual plants. The NAEI website has a number of national emission maps that cover a wide variety of pollutants. The maps reveal how the Lancashire area compares with other parts of the country. The NAEI website also contains details and trend information on the various forms of air pollutants.

From the NAEI website, we have downloaded the 2022 emissions data per square kilometre for nitrogen oxides, particulates and sulphur dioxide. These are three important pollutants with high emission levels. In comparison, a number of UK maps for the other pollutants record very low emission levels.

Emissions of each pollutant are separated into 11 sectors classified by source according to CORINAIR guidelines. These are

- Combustion in energy production and transformation
- Combustion in commercial, institutional, residential and agriculture
- Combustion in industry
- Production processes
- Extraction and distribution of fossil fuels
- Solvent use
- Road transport
- Other transport and mobile machinery
- Waste treatment and disposal
- Agriculture, forestry and landuse change
- Nature

In addition the grid data is supplied as total area emissions and total values including point source emissions for each pollutant. The point sources are the biggest emitters of various pollutants, especially NO_x and SO_2. These are mostly power stations, steelworks, cement works and other large industrial operations. We have analysed the three main components, road transport, other transport and industrial combustion, for two pollutants, NO_x and $PM_{2.5}$ s, but just industrial combustion for SO_2.

2.1 Nitrogen oxides

The term nitrogen oxides (NO_x) refers to two gases – nitric oxide (NO), and nitrogen dioxide (NO_2). Nitrogen oxides contribute to acid rain by mixing with water particles to form nitric acid, to the depletion of the ozone layer and have detrimental effects on health. They are also greenhouse gases. High emission levels in the county are associated with urban areas and the main road networks. Nitrogen oxides are generated by many types of combustion, irrespective of which fuel is being combusted, because 78% of atmospheric gases are nitrogen. NAEI provide a time-series graph showing the reduction in emissions of this pollutant dating as far back as 1990. The total emissions of NO_x in the Lancashire-12 area fell by -6.5% to 10,153 tonnes from 2021 to 2022. In the wider Lancashire-14 area the fall was only -5% as there were rises of emissions in Blackburn with Darwen and particularly in Blackpool (+14.2%).

2.2 Particulate matter ($PM_{2.5}$)

Particulate matter refers to tiny particles suspended in the air, these are in the mid-range for size of particulates monitored, being less than 2.5 µm in size, and come from transport, industrial, agricultural and mining operations and can be difficult to control. They include not only smoke and dust particles, but also mould and other spores and pollen. Particulates can stick to the surfaces of buildings resulting in blackening of the facades. They can also settle on plants and damage leaves, and for humans they may affect the heart and lungs. Particulates are often seen as one of the most critical of pollutants as a result of their impact on human health, but do not contribute towards acid rain. NAEI provide a time-series graph showing the reduction in emissions of this pollutant dating as far back as 1970. Emissions of particulates rose by 5.4% between 2021 and 2022 in the Lancashire-12 area and by 6% in the Lancashire-14 area.

2.3 Sulphur dioxide

Sulphur dioxide is associated with the combustion of fossil fuels, particularly coal. When most of the country's power stations ran on coal, the output of SO_2 was enormous. In the UK in 1979 the energy and transformation sector was responsible for the generation of 3.475 megatonnes of SO_2. By 2022 this had fallen to 27.6 kilotonnes. The use of coal in energy production has all but been phased out in the UK. SO_2 mixes with chemicals in the air to form sulphuric acid, which falls in acid rain and is damaging to vegetation, forestry and agriculture. Transport is only a very minor source of SO_2, but industrial processes such as those at iron and cement works are major sources.

2.4 The Gothenburg Protocol

The Gothenburg Protocol, or the 1999 Protocol to Abate Acidification, Eutrophication and Ground-level Ozone (as amended in 2012) — forms part of the 1979 UNECE Convention on Long-Range Transboundary Air Pollution (CLRTAP) which aims to protect humans from air pollution. The Convention came about after widespread publicity of studies into the effects of acid rain in the Northern Hemisphere in the 1960s and 70s. The Protocol was signed by 31 parties and has since been ratified by 26, including the EU, other European nations and the USA. The EU also issued a directive: the National Emissions Ceilings Directive (NECD) which excluded certain agricultural emissions, hence setting a lower ceiling for that pollutant. The Protocol originally covered four main pollutants: sulphur dioxide, nitrogen oxides, volatile organic compounds and ammonia, but was amended to include 'dust' or particulates. The protocol does not cover emissions from sea shipping, the volume of which continues to increase. Targets for reduction were set for 2010, and further targets have been set for future dates of which the latest extends to 2029. The ceilings do not change annually, they remain fixed until 2029. For SO_2 the ceiling is a 59% reduction on 2005 levels, for NO_x the ceilings reflect a 55% reduction on 2005 levels for both the CLRTAP and NECD standards and for $PM_{2.5}$s the reduction is 30%. In 2023 the UK achieved the targets for all three of these pollutants.

2.5 Air quality management areas

If a local authority finds an air quality issue in a particular locality, it must declare an air quality management area (AQMA) that could be just one or two streets, or cover a much larger locality. The authority will then put together a plan to improve the air quality. Around the UK some AQMAs monitor NO_2, SO_2 and / or particulates, but in Lancashire only NO_2 is monitored.

3 Analysis of sectors and major point sources

3.1 Road transport.

Across the whole Lancashire-14 area, emissions of NO_x from road transport sources rose by 6% to 4,464 tonnes following two successive annual decreases associated with the Covid-19 pandemic lockdown. The emission of particulates from road

transport sources also rose, from 234 tonnes in 2021 to 252 in 2022. We have now provided more detailed tables and graphics in our Microsoft Power BI interactive report. Table 1 below also gives an indication of the volume of traffic on the roads in 2022.

Table 1, vehicle kilometres and daily flow of traffic, 2022

	Millions of vehicle kilometres				Vehicles
	Cars	Vans and HGVs	Trunk roads	All roads	Annual average daily flow*
Blackburn with Darwen	534	133	194	673	3,502
Blackpool	425	78	2	510	3,126
Lancashire-12	8,696	2,541	4,435	11,354	4,399
Lancashire-14	**9,656**	**2,751**	**4,631**	**12,537**	4,270

Source: Department for Transport, road traffic statistics, Traffic by authority (TRA89)

* *The number of vehicles passing in 24 hours at an average point on the road network in each local authority. This controls for differing length of road in each authority, providing a measure of how heavily used the roads are.*
It is calculated by dividing the estimate of annual vehicle miles (or km) in each local authority by the length of road in that authority and number of days in the year

Table 5 gives summary data of the emissions which have road transport as their source. We have calculated these by converting the NAEI data into a form that could be more easily analysed geographically. For the analysis we have used ESRI ArcGIS Pro and Tisler QGIS Geographic Information System software. A more detailed table with district results is available as a Microsoft Excel download.

3.2 High emissions of pollution from various sectors

Slide (or page) 2 of the Microsoft Power BI report on air pollution analyses the 1km squares with the highest emissions. This time we are showing all squares where emissions exceed 0.1 tonnes. This year we note the 95 tonnes of NO_x from the Shadsworth Business Park in Blackburn. Also noted are the 100 tonnes of NO_x from industrial sources in the Blackpool and Fylde Industrial Estate.

3.3 Point source emissions

The major point sources are now also mapped in the same Microsoft Power BI report that shows the high area emissions mentioned above (slide 4). They are all mapped, but the list displayed is restricted to the top 20 in Lancashire. The Ribblesdale Cement Works near Clitheroe in Ribble Valley continues to be a major source of NO_x and SO_2. In 2022 there were 646 tonnes of NO_x and 112 tonnes of SO_2 directly attributed to the works. The full list is available on the NAEI website.